

In the third paragraph on page 2 of the above-identified Office action, claims 3-6 have been rejected as being obvious over *Muraoka et al.* (US 5,324,966) in view of *Mori et al.* (Proceedings of the 1998 International Symposium on Power Semiconductor Devices & ICs), *Seki* (US 5,025,293), and *Baliga* (US 5,396,087) under 35 U.S.C. § 103.

As will be explained below, it is believed that the claims were patentable over the cited art in their original form and the claims have, therefore, not been amended to overcome the references.

Before discussing the prior art in detail, it is believed that a brief review of the invention as claimed, would be helpful.

Claim 3 (similarly claim 5) calls for, inter alia:

A semiconductor component, comprising:

...

a first base region having a weak doping with a given conductivity type;

...

a **buffer layer** being doped to have said given conductivity type, said buffer layer being disposed between said first base region and one of said two remaining regions connected to said drain contact;

... a doping of said buffer layer being chosen such that, in an operating state in which the semiconductor component effects **blocking in a direction from said source contact toward said drain contact**, at least in an envisaged range of applied electrical voltages, a space charge zone present in said first base region is formed in a manner extending at least as far as said buffer layer; and

a **further buffer layer** being doped to have said given conductivity type and being disposed between said first base region and said second base region, a doping of said further buffer layer having a magnitude causing the semiconductor component **to block in a direction from said drain contact toward said source contact** in an envisaged range of opposite applied electrical voltages.

On page 3 of the Office action, the Examiner stated in regard to the applied secondary references:

Muraoka et al. fail to teach a further buffer layer being doped to have a given conductivity type; a second base region extending as far as the first main side and a source contact being connected to a second base region. Mori et al. teach a further buffer layer n being doped to have a given conductivity type and being disposed between the first base region p and the second base region p+ (Figure 1(b), page 429). Seki teaches a further buffer layer 2b being doped to have the given conductivity type (Figure 1, cols. 3-4, lines 31-68 and 1-68, respectively). Baliga teaches a second base region 19 extending as far as the first main side and a source contact 20 being connected to a second base region (Figure 3, col. 6, lines 18-65). Baliga further teaches a doping of a layer having a magnitude causing the semiconductor component to block in a direction from the drain contact toward the source contact (reverse) in an envisaged range of opposite applied electrical voltages (cols. 2-4, lines 43-51, 14-26 and 42-44, respectively).

Since Muraoka et al., Mori et al., Seki and Baliga are from the same field of endeavor (buffered semiconductor components), the purpose disclosed by Mori et al., Seki and Baliga would have been recognized in the pertinent art of Muraoka et al. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the buffered semiconductor component as taught by Muraoka et al. by incorporating the buffer layer of Mori et al., the further buffer layer as taught by Seki and the reverse blocking as taught by Baliga to provide directional power flow control (col. 3, lines 14-26).

Discussion regarding the secondary reference Mori et al.

The Examiner applied *Mori et al.* to "teach a further buffer layer n being doped to have a given conductivity type and being disposed between the first base region p and the second base region p+ (Figure 1(b), page 429)."

However, the n-doped layer in *Mori et al.* does not form a buffer layer, the n-doped layer surrounding the p-doped second base region forms a hole-barrier layer acting as a barrier layer to holes injected from the p+-doped layer (see page 430, left column, second paragraph in *Mori et al.*).

The hole-barrier layer in *Mori et al.* has the effect that the hole region, especially the region near the p-layer, is better modulated resulting in an, allegedly, higher conductivity. In contrast, the further buffer layer in the present invention is disposed between the first base region and the second base region with a chosen magnitude of doping such that the semiconductor component blocks in a direction from the drain

contact towards that source contact in an envisaged range of opposite applied electrical voltages.

In other words, the component according to the present invention as recited in the claims provides a bidirectional switch. Neither *Muraoka et al.* nor *Mori et al.* disclose a bidirectional switch due to the fact that these references do not disclose or suggest a further buffer layer serving as a switch in the reverse direction.

Discussion regarding the secondary reference *Seki*

The Examiner applied *Seki* to teach "a further buffer layer 2b being doped to have the given conductivity type (Figure 1, cols. 3-4, lines 31-68 and 1-68, respectively)." *Seki* describes an IGBT with two buffer layers. However, the second buffer layer (reference no. 2b in Figure 1 of *Seki*) has a different function than the second buffer layer in the present invention, namely to reduce the on-resistance in the conductivity modulation type. This difference is clear from the arrangement of the second buffer layer within the semiconductor component. The second buffer layer in *Seki* is arranged directly on the first buffer layer (reference no. 2a in Figure 1) and not, as in the present invention, between the first base region and the second base region.

In contrast, in the present invention as recited in the claims, the purpose of the further buffer layer is to allow the semiconductor component to block in the direction from the drain contact toward the source contact.

MPEP § 2143.01 (8th Edition, 1st Revision) states:

THE PRIOR ART MUST SUGGEST THE DESIRABILITY OF THE CLAIMED INVENTION

...

Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art. "The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art." [Case citations].

The inventive concept of the invention of the instant application is to have a bidirectional switch with a buffer layer on the source side and a further buffer layer on the drain side, thereby combining the advantage of punch-through dimensioning (small thickness of the component) with the advantage of non-punch-through dimensioning (possibility of symmetrical blocking capability). Without an explicit or implicit disclosure or suggestion of this inventive concept of using **two** buffer layers for a bidirectional switch, the

present invention cannot be obvious. *Muraoka et al.* in view of *Mori et al.*, *Seki*, and *Baliga* do not disclose or suggest a semiconductor with a buffer layer on the source side and a further buffer layer on the drain side, in order to form a bidirectional switch. Therefore, the invention as recited in claims 3 and 5 of the instant application is believed not to be obvious over *Muraoka et al.* in view of *Mori et al.*, *Seki*, and *Baliga*.

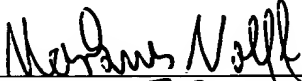
It is accordingly believed to be clear that *Muraoka et al.* in view of *Mori et al.*, *Seki*, and *Baliga* do not suggest the features of claims 3 and 5. Claims 3 and 5 are, therefore, believed to be patentable over the art and because claims 4 and 6 are ultimately dependent either claim 3 or claim 5, they are believed to be patentable as well.

In view of the foregoing, reconsideration and allowance of claims 3-6 are solicited.

Petition for extension is herewith made. The extension fee for response within a period of two months pursuant to Section 1.136(a) in the amount of \$ 420.00 in accordance with Section 1.17 is enclosed herewith.

Please charge any other fees that might be due with respect to Sections 1.16 and 1.17 to the Deposit Account of Lerner and Greenberg, P.A., No. 12-1099.

Respectfully submitted,



Markus Nozif (Reg. No. 37,006)

February 17, 2004

Lerner and Greenberg, P.A.
Post Office Box 2480
Hollywood, FL 33022-2480
Tel: (954) 925-1100
Fax: (954) 925-1101